WHAT IS CLAIMED IS:

1. A method for reversibly converting a data format in that a forward transformation and a backward transformation are reciprocally conducted for data between unit systems having different resolution levels,

wherein in the forward transformation and the backward transformation, a first unit system having a lower resolution level is used as a common unit system, and a reversible data conversion is conducted by an integer operation for data in the first unit system having the lower resolution level and data in a second unit system having a higher resolution level higher than the first unit system.

2. The method as claimed in claim 1, wherein the first unit system is a first color space having the lower resolution level, and the second unit system is a second color space having the higher resolution level,

wherein in a case in that a digital color

conversion by quantizing the first color space having the lower resolution level and being analog, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

3. The method as claimed in claim 2, wherein the first data in the first color space are YCbCr data, and the second data in the second color space are RGB data, and the third data in the first color space are Y′Cb′Cr′, and in a case of converting to the Y′Cb′Cr′ data after the YCbCr data is converted into the RGB data,

when the forward transformation is conducted from the RGB data to the Y′Cb′CR′ data, a first formula is conducted by an integer operation of a color converting functions where the first formula is defined as

$$Y = \left\lfloor \frac{219 \times (299 \times R + 587 \times G + 114 \times B) + 16 \times 255 \times 1000 + 255 \times 1000/2}{255 \times 1000} \right\rfloor \text{※}$$

$$Cb = \left\lfloor \frac{224 \times 564 \times (-299 \times R - 587 \times G + 886 \times B) + 128 \times 255 \times 1000 \times 1000 + 255 \times 1000 \times 1000/2}{255 \times 1000 \times 1000} \right\rfloor$$

$$Cr = \left\lfloor \frac{224 \times 713 \times (701 \times R - 587 \times G - 114 \times B) + 128 \times 255 \times 1000 \times 1000 + 255 \times 1000 \times 1000/2}{255 \times 1000 \times 1000} \right\rfloor$$

※ $\lfloor\ \rfloor$: round a fractional part and the same in the following

and when the backward transformation is conducted from the RGB data to the YCbCr data, a second formula is conducted by an integer operation of a color converting functions where the second formula is defined as

$$R = \left\lfloor \frac{[219 \times 1000 \times (Cr - 128) + 713 \times 224 \times (Y - 16)] \times 255 + 713 \times 224 \times 219/2}{713 \times 224 \times 219} \right\rfloor$$

$$G = \left\lfloor \frac{\begin{bmatrix} 713 \times 224 \times 587 \times 564(Y - 16) \\ - 299 \times 219 \times 564 \times 1000 \times (Cr - 128) \\ - 114 \times 219 \times 713 \times 1000 \times (Cb - 128) \end{bmatrix} \times 255 + 219 \times 713 \times 224 \times 587 \times 564/2}{219 \times 713 \times 224 \times 587 \times 564} \right\rfloor$$

$$B = \left\lfloor \frac{[219 \times 1000 \times (Cb - 128) + 564 \times 224 \times (Y - 16)] \times 255 + 564 \times 224 \times 219/2}{564 \times 224 \times 219} \right\rfloor$$

.

4. The method as claimed in claim 1, wherein the first unit system is a first color space having the lower

resolution level and the second unit system is a second color space having the higher resolution level,

wherein in a case in that a digital color conversion by quantizing the first color space having the lower resolution level and being analog, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

5. The method as claimed in claim 4, wherein the first data in the first color space are YCbCr data, and the second data in the second color space are RGB data, and the third data in the first color space are Y′Cb′Cr′, and in a case of converting to the Y′Cb′Cr′ data after the YCbCr data is converted into the RGB data,

the forward transformation from the second data in the second color space to the third data in the first

color space is conducted by an integer operation where MAX denotes a maximum value of the resolution level and Y, M, and C are set to be Y=MAX-B, M=MAX-G, and C=MAX-R in the first formula, and

the backward transformation from the first data in the first color space to the second data in the second color space is conducted by an integer operation where MAX denotes a maximum value of the resolution level and Y, M, and C are set to be Y=MAX-B, M=MAX-G, and C=MAX-R in the second formula.

6. The method as claimed in claim 1, wherein the first unit system is a first color space having the lower resolution level and the second unit system is a second color space having the higher resolution level,

wherein in a case of conducing a color conversion in accordance with an international standard in which the data format for converting an analog video signal into digital data is specified, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first

color space to second data in th second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

7. The method as claimed in claim 6, wherein the first data in the first color space are YCbCr data, and the second data in the second color space are quantized R(d)G(d)B(d) data, and the third data in the first color space are Y'Cb'Cr', and in a case of converting to the Y'Cb'Cr' data after the YCbCr data is converted into the RGB data,

in a conversion from an analog R(a)G(a)B(a) data to the YCbCr data, the forward transformation from the YCbCr data by conducting a color converting function in a third formula defined as

$$Y = \left\lfloor \frac{219 \times (77 \times R(a) + 150 \times G(a) + 29 \times B(a)) + 16 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

$$Cb = \left\lfloor \frac{219 \times (-44 \times R(a) - 87 \times G(a) + 131 \times B(a)) + 128 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

$$Cr = \left\lfloor \frac{219 \times (131 \times R(a) - 110 \times G(a) - 21 \times B(a)) + 128 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

to the R(d)G(d)B(d) data is conducted by an integer operation of a color converting function in a fourth formula defined as

$$R(d)=\left\lfloor\frac{(16772821\times Y+22904709\times Cr-41320\times Cb-2926513792)\times 2+16772821}{16772821\times 2}\right\rfloor$$

$$G(d)=\left\lfloor\frac{(470873\times Y-329527\times Cr-157064\times Cb+62283648)\times 2+470873}{470873\times 2}\right\rfloor$$

$$B(d)=\left\lfloor\frac{(16772821\times Y-102267\times Cr+29047960\times Cb-3705048704)\times 2+16772821}{16772821\times 2}\right\rfloor$$

and when the backward transformation is conducted from the R(d)G(d)B(d) data to the Y'Cb'Cr' data, a fifth formula is conducted by an integer operation of a color converting functions where the second formula is defined as

$$Y'=\left\lfloor\frac{77\times R(d)+150\times G(d)+29\times B(d)+128}{256}\right\rfloor$$

$$Cb'=\left\lfloor\frac{-44\times R(d)-87\times G(d)+131\times B(d)+128\times 256+128}{256}\right\rfloor$$

$$Cr'=\left\lfloor\frac{131\times R(d)-110\times G(d)-21\times B(d)+128\times 256+128}{256}\right\rfloor.$$

8, The method as claimed in claim 1, wherein the first unit system is a first color space having the lower resolution level, and the second unit system is a second

color space having the higher r solution level,

wherein in a case of conducting an original color based on the brightness and the color difference, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

9. The method as claimed in claim 8, wherein the first data in the first color space are Y(o)Cb(o)Cr(o) data, and the second data in the second color space are R(o)G(o)B(o) data, and the third data in the first color space are Y(o)'Cb(o)'Cr(o)', and in a case of converting to the Y(o)'Cb(o)'Cr(o)' data after the Y(o)Cb(o)Cr(o) data is converted into the R(o)G(o)B(o) data,

when the forward transformation is conducted from the RGB data to the Y(o)'Cb(o)'CR(o)' data, a sixth formula is conducted by an integer operation of a color

converting functions where the sixth formula is defined as

$$Y(o)=\left\lfloor \frac{2\times(x_M\times R(o)+(D-x_M-y_M)\times G(o)+y_M\times B(o))+D}{2\times D}\right\rfloor$$

$$Cb(o)=\left\lfloor \frac{\left\lfloor \frac{MAX_{RGB}+1}{2}\right\rfloor\times 2\times(D-y_M)-x_M\times R(o)-(D-x_M-y_M)\times G(o)+(D-y_M)\times(B(o)+1)}{2\times(D-y_M)}\right\rfloor -\left\lfloor \frac{MAX_{RGB}+1}{2}\right\rfloor$$

$$Cr(o)=\left\lfloor \frac{\left\lfloor \frac{MAX_{RGB}+1}{2}\right\rfloor\times 2\times(D-x_M)+(D-x_M)\times(R(o)+1)-(D-x_M-y_M)\times G(o)-y_M\times B(o)}{2\times(D-x_M)}\right\rfloor -\left\lfloor \frac{MAX_{RGB}+1}{2}\right\rfloor$$

and when the backward transformation is conducted from the R(o)G(o)B(o) data to the Y(o)Cb(o)Cr(o) data, a seventh formula is conducted by an integer operation of a color converting functions where the seventh formula is defined as

$$R(o)=\left\lfloor \frac{2\times(D\times Y(o)+2\times(D-x_M)\times Cr(o))+D}{2\times D}\right\rfloor$$

$$G(o)=\left\lfloor \frac{\left(2\times((D-x_M-y_M)\times D\times Y(o)-2\times y_M\times(D-y_M)\times Cb(o)-2\times x_M\times(D-x_M)\times Cr(o)) + (D-x_M-y_M)\times D\right)}{2\times(D-x_M-y_M)\times D}\right\rfloor$$

$$B(o)=\left\lfloor \frac{2\times(D\times Y(o)+2\times(D-y_M)\times Cb(o))+D}{2\times D}\right\rfloor$$

.

10. The method as claimed in claim 9, wherein a color conversion for the original color based on the brightness and the color difference,

the first data in the first color space are Y(o)Cb(o)Cr(o) data, and the second data in the second color space are R(o)G(o)B(o) data, and the third data in the first color space are Y(o)'Cb(o)'Cr(o)', and in a case of converting to the Y(o)'Cb(o)'Cr(o)' data after the Y(o)Cb(o)Cr(o) data is converted into the R(o)G(o)B(o) data,

when the forward transformation is conducted from the RGB data to the Y(o)'Cb(o)'CR(o)' data, an eighth formula is conducted by an integer operation of a color converting functions where the eighth formula is defined as

$$Y(o)=\left\lfloor \frac{(299\times R(o)+587\times G(o)+114\times B(o))+500}{1000} \right\rfloor$$

$$Cb(o)=\left\lfloor \frac{128\times 2\times 886-299\times R(o)-587\times G(o)+886\times (B(o)+1)}{2\times 886} \right\rfloor-128$$

$$Cr(o)=\left\lfloor \frac{128\times 2\times 701+701\times (R(o)+1)-587\times G(o)-114\times B(o)}{2\times 701} \right\rfloor-128$$

and when the backward transformation is conducted from the R(o)G(o)B(o) data to the Y(o)Cb(o)Cr(o) data, a ninth formula is conducted by an integer operation

of a color converting functions where the ninth formula is defined as

$$R(o) = \left\lfloor \frac{(1000 \times Y(o) + 1402 \times Cr(o)) + 500}{1000} \right\rfloor$$
$$G(o) = \left\lfloor \frac{(587 \times 1000 \times Y(o) - 2 \times 114 \times 886 \times Cb(o) - 2 \times 299 \times 701 \times Cr(o)) + 587 \times 500}{587 \times 1000} \right\rfloor$$
$$B(o) = \left\lfloor \frac{(1000 \times Y(o) + 1772 \times Cb(o)) + 500}{1000} \right\rfloor$$

.

11. The method as claimed in claim 9 or 10, wherein maximum values and minimum value are limited in available ranges for the R(o)G(o)B(o) data and the Y(o)Cb(o)Cr(o) data.

12. The method as claimed in claim 1, wherein the first unit system is a BMU unit system using an inch unit system and the second unit system is a 1/100 mm unit system using a meter unit system, and by using the first color space as the common unit system, the reversible data

conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

13. The method as claimed in claim 12, wherein after the first data shown in the BNU unit system is converted into the second data shown in the 1/100 mm using the meter unit system, a tenth formula is conducted to convert to the third data showing the BMU unit system where the tenth formula is defined as

$$<1/100\text{mm data}> = \lfloor (2540 \times <\text{BMU data}> + 600)/1200 \rfloor$$

$$<\text{BMU data}> = \lfloor (1200 \times <1/100\text{mm data}> + 1270)/2540 \rfloor.$$

14. An apparatus for reversibly converting a

data format in that a forward transformation and a backward transformation are reciprocally conducted for data between unit systems having different resolution levels, comprising a data format reversibly converting part for reversibly converting a data format,

wherein in the forward transformation and the backward transformation, a first unit system having a lower resolution level is used as a common unit system, and a reversible data conversion is conducted by an integer operation for data in the first unit system having the lower resolution level and data in a second unit system having a higher resolution level higher than the first unit system.

15. The apparatus as claimed in claim 14, wherein the data format reversibly converting part conducts the reversible data conversion in that the first unit system is a first color space having the lower resolution level, and the second unit system is a second color space having the higher resolution level,

wherein the data format reversibly converting part conducts a reversible data conversion in a case in that a digital color conversion by quantizing the first color

space having the lower resolution level and being analog, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

16. The method as claimed in claim 15, wherein the data format reversibly converting part conducts the reversible data conversion in that the first data in the first color space are YCbCr data, and the second data in the second color space are RGB data, and the third data in the first color space are Y'Cb'Cr', and in a case of converting to the Y'Cb'Cr' data after the YCbCr data is converted into the RGB data,

when the forward transformation is conducted from the RGB data to the Y'Cb'CR' data, a first formula is conducted by an integer operation of a color converting functions where the first formula is defined as

$$Y = \left\lfloor \frac{219\times(299\times R+587\times G+114\times B)+16\times 255\times 1000+255\times 1000/2}{255\times 1000} \right\rfloor \text{※}$$

$$Cb = \left\lfloor \frac{224\times 564\times(-299\times R-587\times G+886\times B)+128\times 255\times 1000\times 1000+255\times 1000\times 1000/2}{255\times 1000\times 1000} \right\rfloor$$

$$Cr = \left\lfloor \frac{224\times 713\times(701\times R-587\times G-114\times B)+128\times 255\times 1000\times 1000+255\times 1000\times 1000/2}{255\times 1000\times 1000} \right\rfloor$$

※ $\lfloor\ \rfloor$: round a fractional part and the same in the following

and when the backward transformation is conducted from the RGB data to the YCbCr data, a second formula is conducted by an integer operation of a color converting functions where the second formula is defined as

$$R = \left\lfloor \frac{[219\times 1000\times(Cr-128)+713\times 224\times(Y-16)]\times 255+713\times 224\times 219/2}{713\times 224\times 219} \right\rfloor$$

$$G = \left\lfloor \frac{\begin{bmatrix} 713\times 224\times 587\times 564(Y-16) \\ -299\times 219\times 564\times 1000\times(Cr-128) \\ -114\times 219\times 713\times 1000\times(Cb-128) \end{bmatrix}\times 255+219\times 713\times 224\times 587\times 564/2}{219\times 713\times 224\times 587\times 564} \right\rfloor$$

$$B = \left\lfloor \frac{[219\times 1000\times(Cb-128)+564\times 224\times(Y-16)]\times 255+564\times 224\times 219/2}{564\times 224\times 219} \right\rfloor$$

.

17. The apparatus as claimed in claim 14, wherein the data format reversibly converting part conducts

the reversible data conversion in that the first unit system is a first color space having the lower resolution level and the second unit system is a second color space having the higher resolution level,

wherein in a case in that a digital color conversion by quantizing the first color space having the lower resolution level and being analog, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

18. The apparatus as claimed in claim 17, wherein the first data in the first color space are YCbCr data, and the second data in the second color space are RGB data, and the third data in the first color space are Y′Cb′Cr′, and in a case of converting to the Y′Cb′Cr′ data after the YCbCr data is converted into the RGB data,

the forward transformation from the second data in the second color space to the third data in the first color space is conducted by an integer operation where MAX denotes a maximum value of the resolution level and Y, M, and C are set to be Y=MAX-B, M=MAX-G, and C=MAX-R in the first formula, and

the backward transformation from the first data in the first color space to the second data in the second color space is conducted by an integer operation where MAX denotes a maximum value of the resolution level and Y, M, and C are set to be Y=MAX-B, M=MAX-G, and C=MAX-R in the second formula.

19. The apparatus as claimed in claim 14, wherein the data format reversibly converting part conducts the reversible data conversion in that the first unit system is a first color space having the lower resolution level and the second unit system is a second color space having the higher resolution level,

wherein in a case of conducing a color conversion in accordance with an international standard in which the data format for converting an analog video signal

into digital data is specified, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

20. The apparatus as claimed in claim 19, wherein the data format reversibly converting part conducts the reversible data conversion in that the first data in the first color space are YCbCr data, and the second data in the second color space are quantized R(d)G(d)B(d) data, and the third data in the first color space are Y'Cb'Cr', and in a case of converting to the Y'Cb'Cr' data after the YCbCr data is converted into the RGB data,

in a conversion from an analog R(a)G(a)B(a) data to the YCbCr data, the forward transformation from the YCbCr data by conducting a color converting function in a third formula defined as

$$Y = \left\lfloor \frac{219 \times (77 \times R(a) + 150 \times G(a) + 29 \times B(a)) + 16 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

$$Cb = \left\lfloor \frac{219 \times (-44 \times R(a) - 87 \times G(a) + 131 \times B(a)) + 128 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

$$Cr = \left\lfloor \frac{219 \times (131 \times R(a) - 110 \times G(a) - 21 \times B(a)) + 128 \times 256 \times 256 + 256 \times 128}{256 \times 256} \right\rfloor$$

to the R(d)G(d)B(d) data is conducted by an integer operation of a color converting function in a fourth formula defined as

$$R(d) = \left\lfloor \frac{(16772821 \times Y + 22904709 \times Cr - 41320 \times Cb - 2926513792) \times 2 + 16772821}{16772821 \times 2} \right\rfloor$$

$$G(d) = \left\lfloor \frac{(470873 \times Y - 329527 \times Cr - 157064 \times Cb + 62283648) \times 2 + 470873}{470873 \times 2} \right\rfloor$$

$$B(d) = \left\lfloor \frac{(16772821 \times Y - 102267 \times Cr + 29047960 \times Cb - 3705048704) \times 2 + 16772821}{16772821 \times 2} \right\rfloor$$

and when the backward transformation is conducted from the R(d)G(d)B(d) data to the Y(d)'Cb(d)'Cr(d)' data, a fifth formula is conducted by an integer operation of a color converting functions where the fifth formula is defined as

$$Y' = \left\lfloor \frac{77 \times R(d) + 150 \times G(d) + 29 \times B(d) + 128}{256} \right\rfloor$$

$$Cb' = \left\lfloor \frac{-44 \times R(d) - 87 \times G(d) + 131 \times B(d) + 128 \times 256 + 128}{256} \right\rfloor$$

$$Cr' = \left\lfloor \frac{131 \times R(d) - 110 \times G(d) - 21 \times B(d) + 128 \times 256 + 128}{256} \right\rfloor .$$

21, The apparatus as claimed in claim 14, wherein the data format reversibly converting part conducts the reversible data conversion in that the first unit system is a first color space having the lower resolution level, and the second unit system is a second color space having the higher resolution level,

wherein in a case of conducting an original color based on the brightness and the color difference, by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

22. The apparatus as claimed in claim 21, wherein the data format reversibly converting part conducts the reversible data conversion in that the first data in

the first color space are Y(o)Cb(o)Cr(o) data, and the second data in the second color space are R(o)G(o)B(o) data, and the third data in the first color space are Y(o)'Cb(o)'Cr(o)', and in a case of converting to the Y(o)'Cb(o)'Cr(o)' data after the Y(o)Cb(o)Cr(o) data is converted into the R(o)G(o)B(o) data,

when the forward transformation is conducted from the RGB data to the Y(o)'Cb(o)'CR(o)' data, a sixth formula is conducted by an integer operation of a color converting functions where the sixth formula is defined as

$$Y(o)=\left\lfloor \frac{2\times(x_M\times R(o)+(D-x_M-y_M)\times G(o)+y_M\times B(o))+D}{2\times D} \right\rfloor$$

$$Cb(o)=\left\lfloor \frac{\left\lfloor \frac{MAX_{RGB}+1}{2} \right\rfloor \times 2\times(D-y_M)-x_M\times R(o)-(D-x_M-y_M)\times G(o)+(D-y_M)\times(B(o)+1)}{2\times(D-y_M)} \right\rfloor - \left\lfloor \frac{MAX_{RGB}+1}{2} \right\rfloor$$

$$Cr(o)=\left\lfloor \frac{\left\lfloor \frac{MAX_{RGB}+1}{2} \right\rfloor \times 2\times(D-x_M)+(D-x_M)\times(R(o)+1)-(D-x_M-y_M)\times G(o)-y_M\times B(o)}{2\times(D-x_M)} \right\rfloor - \left\lfloor \frac{MAX_{RGB}+1}{2} \right\rfloor$$

and when the backward transformation is conducted from the R(o)G(o)B(o) data to the Y(o)Cb(o)Cr(o) data, a seventh formula is conducted by an integer operation of a color converting functions where the seventh formula is defined as

$$R(o)=\left\lfloor \frac{2\times(D\times Y(o)+2\times(D-x_M)\times Cr(o))+D}{2\times D} \right\rfloor$$

$$G(o)=\left\lfloor \frac{\begin{pmatrix} 2\times((D-x_M-y_M)\times D\times Y(o)-2\times y_M\times(D-y_M)\times Cb(o)-2\times x_M\times(D-x_M)\times Cr(o)) \\ +(D-x_M-y_M)\times D \end{pmatrix}}{2\times(D-x_M-y_M)\times D} \right\rfloor$$

$$B(o)=\left\lfloor \frac{2\times(D\times Y(o)+2\times(D-y_M)\times Cb(o))+D}{2\times D} \right\rfloor$$

23. The apparatus as claimed in claim 22, wherein the data format reversibly converting part conducts the reversible data conversion in that a color conversion for the original color based on the brightness and the color difference,

the first data in the first color space are Y(o)Cb(o)Cr(o) data, and the second data in the second color space are R(o)G(o)B(o) data, and the third data in the first color space are Y(o)'Cb(o)'Cr(o)', and in a case of converting to the Y(o)'Cb(o)'Cr(o)' data after the Y(o)Cb(o)Cr(o) data is converted into the R(o)G(o)B(o) data,

when the forward transformation is conducted from the RGB data to the Y(o)'Cb(o)'CR(o)' data, an eighth

formula is conducted by an integer operation of a color converting functions where the eighth formula is defined as

$$Y(o)=\left\lfloor \frac{(299 \times R(o)+587 \times G(o)+114 \times B(o))+500}{1000} \right\rfloor$$

$$Cb(o)=\left\lfloor \frac{128 \times 2 \times 886 - 299 \times R(o)-587 \times G(o)+886 \times (B(o)+1)}{2 \times 886} \right\rfloor -128$$

$$Cr(o)=\left\lfloor \frac{128 \times 2 \times 701 + 701 \times (R(o)+1)-587 \times G(o)-114 \times B(o)}{2 \times 701} \right\rfloor -128$$

and when the backward transformation is conducted from the R(o)G(o)B(o) data to the Y(o)Cb(o)Cr(o) data, a ninth formula is conducted by an integer operation of a color converting functions where the ninth formula is defined as

$$R(o)=\left\lfloor \frac{(1000\times Y(o)+1402\times Cr(o))+500}{1000} \right\rfloor$$

$$G(o)=\left\lfloor \frac{(587\times 1000\times Y(o)-2\times 114\times 886\times Cb(o)-2\times 299\times 701\times Cr(o))+587\times 500}{587\times 1000} \right\rfloor$$

$$B(o)=\left\lfloor \frac{(1000\times Y(o)+1772\times Cb(o))+500}{1000} \right\rfloor$$

.

24. The apparatus as claimed in claim 22 or 23, wherein the data format reversibly converting part conducts

the reversible data conversion in that maximum values and minimum value are limited in available ranges for the R(o)G(o)B(o) data and the Y(o)Cb(o)Cr(o) data.

25. The apparatus as claimed in claim 14, wherein the data format reversibly converting part conducts the reversible data conversion in that the first unit system is a BMU unit system using an inch unit system and the second unit system is a 1/100 mm unit system using a meter unit system, and by using the first color space as the common unit system, the reversible data conversion is conducted by the integer operation, so that the backward transformation from first data in the first color space to second data in the second color space and the forward transformation from the second data in the second color space to third data in the first color space are conducted and the first data corresponds to the third data.

26. The method as claimed in claim 24, wherein

the data format reversibly converting part conducts the reversible data conversion in that after the first data shown in the BNU unit system is converted into the second data shown in the 1/100 mm using the meter unit system, a tenth formula is conducted to convert to the third data showing the BMU unit system where the tenth formula is defined as

$$\langle 1/100\text{mm data}\rangle = \lfloor (2540 \times \langle \text{BMU data}\rangle + 600)/1200 \rfloor$$

$$\langle \text{BMU data}\rangle = \lfloor (1200 \times \langle 1/100\text{mm data}\rangle + 1270)/2540 \rfloor.$$

27. The method as claimed in claim 1, wherein the integer operation conducts the reversible conversion using powers of 2.

28. The method as claimed in claim 10, wherein the forward transformation from the R(o)G(o)B(o) data to the Y(o)'Cb(o)'Cr(o)' data is conducted by an eleventh formula using powers of 2 derived from the sixth formula

where the eleventh formula is defined as

$$Y(o)=\frac{(128\times 2^{12})+1225\times R(o)+2404\times G(o)+467\times B(o)+2^{11}}{2^{12}}-128$$

$$Cb(o)=\frac{(128\times 2^{12})-691\times R(o)-1357\times G(o)+2^{11}\times B(o)+2^{11}}{2^{12}}-128$$

$$Cr(o)=\frac{(128\times 2^{12})-2^{11}\times R(o)-1715\times G(o)-333\times B(o)+2^{11}}{2^{12}}-128$$

and the backward transformation from the Y(o)Cb(o)Cr(o) data to the R(o)G(o)B(o) data is conducted by a twelfth formula using powers of 2 derived from the seventh formula where the twelfth formula is defined as

$$R(o)=\frac{(128\times 2^{12})+2^{12}\times Y(o)+5743\times Cr(o)+2^{11}}{2^{12}}-128$$

$$G(o)=\frac{(128\times 2^{12})+2^{12}\times Y(o)-1410\times Cb(o)-2925\times Cr(o)+2^{11}}{2^{12}}-128$$

$$B(o)=\frac{(128\times 2^{12})+2^{12}\times Y(o)+7258\times Cb(o)+2^{11}}{2^{12}}-128$$

29. The method as claimed in claim 27, wherein the powers of 2 is conducted by bit shifts.

30. The method as claimed in claim 28, wherein

the forward transformation from the R(o)G(o)B(o) data to the Y(o)'Cb(o)'Cr(o)' data is conducted by a thirteenth formula using powers of 2 derived from the sixth formula where the thirteenth formula is defined as

$$Y(o)=(((128\ll 12)+1225\times R(o)+2404\times G(o)+467\times B(o)+(1\ll 11))\gg 12)-128;$$
$$Cb(o)=(((128\ll 12)-691\times R(o)-1357\times G(o)+2048\times B(o)+(1\ll 11))\gg 12)-128;$$
$$Cr(o)=(((128\ll 12)-2048\times R(o)-1715\times G(o)-333\times B(o)+(1\ll 11))\gg 12)-128;$$

and the backward transformation from the Y(o)Cb(o)Cr(o) data to the R(o)G(o)B(o) data is conducted by a fourteenth formula using powers of 2 derived from the seventh formula where the fourteenth formula is defined as

$$R(o)=(((128\langle\langle 12)+4096\times Y(o)+5743\times Cr(o)+(1\langle\langle 11))\rangle\rangle 12)-128;$$
$$G(o)=(((128\langle\langle 12)+4096\times Y(o)-1410\times Cb(o)-2925\times Cr(o)+(1\langle\langle 11))\rangle\rangle 12)-128;$$
$$B(o)=(((128\langle\langle 12)+4096\times Y(o)+7258\times Cb(o)+(1\langle\langle 11))\rangle\rangle 12)-128;$$

.

31. The method as claimed in claim 2, wherein at a conversion from data in the first unit system to data in the second unit system and a conversion from data in the second unit system to data in the first unit system, a process for rounding up if 5 or greater and rounding down

if less than 5 is conducted.

32. The method as claimed in claim 2, wherein a first process for rounding up if 5 or greater and rounding down if less than 5 is conducted at a conversion from data in the first unit system to data in the second unit system, and a second process for rounding up if 6 or greater and rounding down if less than 6 is conducted at a conversion from data in the second unit system to data in the first unit system,

33. A computer-executable program to cause a computer to reversibly transform a data format, in that a forward transformation and a backward transformation are reciprocally conducted for data between unit systems having different resolution levels,

wherein in the forward transformation and the backward transformation, a first unit system having a lower resolution level is used as a common unit system, and a reversible data conversion is conducted by an integer

operation for data in the first unit system having the lower resolution level and data in a second unit system having a higher resolution level higher than the first unit system.

34. A computer-readable recording medium recording program code to cause a computer to reversibly transform a data format, in that a forward transformation and a backward transformation are reciprocally conducted for data between unit systems having different resolution levels,

wherein in the forward transformation and the backward transformation, a first unit system having a lower resolution level is used as a common unit system, and a reversible data conversion is conducted by an integer operation for data in the first unit system having the lower resolution level and data in a second unit system having a higher resolution level higher than the first unit system.